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// Computer Program Listing Appendix Under 37 CFR 1.52(e)
// client_info.h
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#ifndef CLIENT_INFO_H
#define CLIENT_INFO_H
#include <alio_session.h>
#include <alio_error.h>
#include <data_object.h>
#include <array.h>
#include "time.h"
#include <client_media_list.h>
class AlioSession;
class ClientInfo: public DataObject
{
public:
    static AlioError TableConfirm( AlioSession* alioSession );
    static AlioError TableDrop( AlioSession* alioSession );
    static AlioError SamplesCreate( AlioSession* alioSession, int base, int count );
    static ClientInfo* Find( AlioSession* alioSession, int id );
    static Array< ClientInfo* >* FindByContactTimeout( Array< ClientInfo *>* results, AlioSession* alioSession, long
long time );
    static Array< ClientInfo* >* FindTopPriorityDownload( Array< ClientInfo *>* results, AlioSession* alioSession );
    static Array< ClientInfo* >* FindNormalPriorityDownload( Array< ClientInfo *>* results, AlioSession* alioSession );
    static Array< ClientInfo* >* FindMediaSource( Array< ClientInfo *>* results, AlioSession* alioSession, int
mediaItemId, bool p2pEnable, bool serverEnable, bool avoidPassive );
    static Array< ClientInfo* >* FindServers( Array< ClientInfo *>* results, AlioSession* alioSession );
    ClientInfo( AlioSession* alioSessionInit );
    ClientInfo( AlioSession* alioSessionInit, int idInit );
    ~ClientInfo();
    AlioError createDBObject();
    AlioError deleteDBObject();
    AlioError updateDBObject();
    AlioError loadDBObject( char** row, int fieldCount );
    void contactTimeoutProcess( long long time );
    void mediaProcess( long long time );
    void ipAddressSet( const char* ipAddressInit );
    char* ipAddressGet();
    void ipPortSet( int ipPortInit );
    int ipPortGet();
    void ipMessagePortSet( int ipMessagePortInit ) { ipMessagePort = ipMessagePortInit; dirtySet(); }
    int ipMessagePortGet() { return ipMessagePort; }
    void ipTransferPortSet( int ipTransferPortInit ) { ipTransferPort = ipTransferPortInit; dirtySet(); }
    int ipTransferPortGet() { return ipTransferPort; }
    void customerIdSet( int customerIdInit ) { customerId = customerIdInit; dirtySet(); }
    int customerIdGet() { return customerId; }
    void uplinkCapacitySet( int uplinkCapacityInit );
    int uplinkCapacityGet();
    void uplinkCurrentSet( int uplinkCurrentInit );
    int uplinkCurrentGet();
    void uplinkLastSet( long long uplinkLastInit ) { uplinkLast = uplinkLastInit; dirtySet(); }

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long long uplinkLastGet() { return uplinkLast; }
void downlinkCapacitySet( int downlinkCapacityInit );
int downlinkCapacityGet();
void downlinkCurrentSet( int downlinkCurrentInit );
int downlinkCurrentGet();
void downlinkLastSet( long long downlinkLastInit ) { downlinkLast = downlinkLastInit; dirtySet(); }
long long downlinkLastGet() { return downlinkLast; }
void storageCapacitySet( long long storageCapacityInit );
long long storageCapacityGet();
void storageCurrentSet( long long storageCurrentInit );
long long storageCurrentGet();
void mediaUnwatchedCountSet( int mediaUnwatchedCountInit ) { mediaUnwatchedCount =
mediaUnwatchedCountInit; dirtySet(); }
int mediaUnwatchedCountGet() { return mediaUnwatchedCount; }
void mediaAvailableCountSet( int mediaAvailableCountInit ) { mediaAvailableCount = mediaAvailableCountInit;
dirtySet(); }
int mediaAvailableCountGet() { return mediaAvailableCount; }
void mediaListSizeSet( int mediaListSizeInit ) { mediaListSize = mediaListSizeInit; dirtySet(); }
int mediaListSizeGet() { return mediaListSize; }
void mediaOutTimeSet( long long mediaOutTimeInit ) { mediaOutTime = mediaOutTimeInit; dirtySet(); }
long long mediaOutTimeGet() { return mediaOutTime; }
void mediaRequestedTimeSet( long long mediaRequestedTimeInit ) { mediaRequestedTime =
mediaRequestedTimeInit; dirtySet(); }
long long mediaRequestedTimeGet() { return mediaRequestedTime; }
void mediaTouchedSet( bool mediaTouchedInit ) { mediaTouched = mediaTouchedInit; dirtySet(); }
bool mediaTouchedGet() { return mediaTouched; }
void connectedSet( bool connectedInit );
bool connectedGet();
void contactLastSet( long long contactLastInit );
long long contactLastGet();
void contactTimeoutSet( long long contactTimeoutInit );
long long contactTimeoutGet();
void passiveSet( bool passiveInit );
bool passiveGet();
void preloadingSet( bool preloadingInit ) { preloading = preloadingInit; dirtySet(); }
bool preloadingGet() { return preloading; }
void serverSet( bool serverInit ) { server = serverInit; dirtySet(); }
bool serverGet() { return server; }
void simulatedSet( bool simulatedInit ) { simulated = simulatedInit; dirtySet(); }
bool simulatedGet() { return simulated; }
int mediaCountGet(){ mediaListConfirm(); return mediaList->sizeGet(); }
int mediaItemForDownloadNextGet();
ClientMedia* clientMediaNew( int mediaId, bool requested, int rank );
ClientMedia* clientMediaGetFromMediaId( int mediaId );
void clientMediaComplete( int mediaId );
int clientMediaIdForMediaIdGet( int mediaInId );
void clientMediaMove( int rankOld, int rankNew );
void clientMediaRemove( int rank );
void clientMediaAdd( int rank, int mediaId );
private:

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AlioSession* alioSession;
void processMessage( Message* message );
void processMessageClientNewConfirm( Array< char* >* arguments );
void init();
static Array< ClientInfo* >* FindByQuery( Array< ClientInfo *>* results, AlioSession* alioSession, char* query );
static ClientInfo* FindFromCache( AlioSession* alioSession, int id );
void mediaListConfirm();
long long timeGet() { return time( 0 ); }
// Kind of database values
ClientMediaList* mediaList;
// DATABASE VALUES
bool server;
char* ipAddress;
int ipTransferPort;
int ipMessagePort;
int customerId;
int uplinkCapacity;
int uplinkCurrent;
long long uplinkLast;
int downlinkCapacity;
int downlinkCurrent;
long long downlinkLast;
long long storageCapacity;
long long storageCurrent;
int mediaUnwatchedCount;
int mediaAvailableCount;
int mediaListSize;
long long mediaOutTime;
long long mediaRequestedTime;
bool mediaTouched;
bool connected;
long long contactLast;
long long contactTimeout;
bool preloading;
bool passive;
bool simulated;
};
#endif
// scheduler.h
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#ifndef SCHEDULER_H
#define SCHEDULER_H
#include "scheduleruiinterface.h"
#include "schedulerinterface.h"
#include <unistd.h>
#include <pthread.h>
#include <alio_session.h>
#include <log.h>
#include <media_info.h>
#include <message.h>

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#include <client_info.h>
#include <client_media.h>
#include <message_engine.h>
#include <transfer.h>
#include <customer.h>
#include <customer_media.h>
/**
    Main Class for the Scheduler
    */
class Scheduler: public SchedulerInterface
{
public:
    Scheduler( int init );
    virtual ~Scheduler() {}
    void uiInterfaceSet( SchedulerUIInterface* uiInterfaceInit );
    // SchedulerInterface
    void run();
    void stop();
    long long timeGet();
    void ipPortSet( int ipPortInit ) { ipPort = ipPortInit; }
    void p2pEnableSet( bool enable );
    void serverEnableSet( bool enable );
    void threadRunning( );
private:
    void iterate( long long secs );
    void processMessage( Message* message );
    void processMessageClientNew( Array< char* >* arguments );
    void processMessageContact( int fromId, Array< char* >* arguments );
    void processMessagePing( int fromId, Array< char* >* arguments );
    void processMessageClientMediaNew( int fromId, Array< char* >* arguments );
    void processMessageClientMediaComplete( int fromId, Array< char* >* arguments );
    void processMessageTransferStarting( int fromId, Array< char* >* arguments );
    void processMessageTransferListening( int fromId, Array< char* >* arguments );
    void processMessageTransferConnecting( int fromId, Array< char* >* arguments );
    void processMessageTransferTransferring( int fromId, Array< char* >* arguments );
    void processMessageTransferProgress( int fromId, Array< char* >* arguments );
    void processMessageTransferComplete( int fromId, Array< char* >* arguments );
    void processMessageTransferTimeout( int fromId, Array< char* >* arguments );
    void processMessageTransferError( int fromId, Array< char* >* arguments );
    void processMessageMediaAuthorizationRequest( int fromId, Array< char* >* arguments );
    void processMessageClientMediaMove( int fromId, Array< char* >* arguments );
    void processMessageClientMediaAdd( int fromId, Array< char* >* arguments );
    void processMessageClientMediaRemove( int fromId, Array< char* >* arguments );
    void messagesMonitor( long long time );
    void medialtemRemove( int clientId, int rank );
    void medialtemMove( int clientId, int rankOld, int rankNew );
    void medialtemAdd( int clientId, int rank, int mediaId );
    bool transfersDesign( bool topPriority );
    void transfersMonitor( long long time );
    void transferAbort( Transfer* transfer );

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Transfer* transferStateSet( int fromId, Transfer::State state, Array< char* >* arguments );
void transferAbortMessageSend( int clientId, int transferId );
void databaseInitialize( int init );
void customerNewCreate( );
void timeSubtract( struct timeval* diff, struct timeval* start, struct timeval* end );
long long randomTime();
AlioSession alioSession;
SchedulerUIInterface* uiInterface;
MessageEngine* messageEngine;
pthread_t runningThread;
pthread_mutex_t runningMutex;
bool running;
long long customerSpawnLast;
int customerCount;
int ipPort;
bool p2pEnable;
bool serverEnable;
bool transferPriority;
};
#endif
// transfer_engine.h
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#ifndef TRANSFER_ENGINE_H
#define TRANSFER_ENGINE_H
#include <alio.h>
#include <alio_session.h>
#include <transfer_engine_interface.h>
#include <transfer.h>
#include <log.h>
#include <array.h>
#include <unistd.h>
#include <pthread.h>
/**
    Main Class for the TransferEngine
    */
#define TRANSFER_ENGINE_QUEUED_CONNECTIONS    5 // what's this for?
#define MAX_BUF_SIZE                          4096 // limit might be intmax
#define CONNECT_RETRIES_MAX                   10
#define BIND_RETRIES_MAX                      5
#define CONNECT_RETRY_SLEEP_SECONDS           5 // 0 means don't sleep
#define BIND_RETRY_SLEEP_SECONDS              1 // 0 means don't sleep
#define TRANSFER_UNIT_SIZE                    4096 // limit might be intmax
#define FILE_CREATE_MODE                      0666 // rw for all
#define ACCEPT_TIMEOUT_SECONDS                30
#define ACCEPT_TIMEOUT_MILLISECONDS           0
class TransferEngine;
class TransferRecord
{
public:
    TransferRecord( TransferEngine* transferEngine,

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        int schedulerTransferId,
        int localId,
        int localTransferPort,
        int localClientMediaId,
        int remotId,
        char* remoteIPAddress,
        int remoteTransferPort,
        bool localActive, bool localSends,
        char* localPath,
        long long start,
        long long length,
        bool virtualTranfer );
~TransferRecord();
TransferEngine* transferEngine;
int schedulerTransferId;
int localId;
int localTransferPort;
int localClientMediaId;
int remotId;
char* remoteIPAddress;
int remoteTransferPort;
bool localActive;
bool localSends;
char* localPath;
long long start;
long long length;
long long current;
bool virtualTransfer;
pthread_t thread;
};
class TransferEngine: public TransferEngineInterface
{
public:
    TransferEngine( int idInit, const char* databaseName );
    virtual ~TransferEngine() { }
    // Transfer Engine Interface
    virtual void callbackInterfaceSet( TransferEngineCallbackInterface* transferEngineCallbackInterfaceInit )
        { transferEngineCallbackInterface = transferEngineCallbackInterfaceInit; }
    virtual void pathBaseSet( const char* pathBaseInit );
    virtual void transferStart( int schedulerId,
                                int localId,
                                int localTransferPort,
                                int localClientMediaId,
                                int remotId,
                                char* remoteIPAddress,
                                int remoteTransferPort,
                                bool localActive, bool localSends,
                                char* localPath,
                                long long start,
                                long long length,

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        bool virtualTransfer );
    virtual void transferCancel( int schedulerId );
    void threadRunning( TransferRecord* transferRecord );
private:
    void databaseConnectionInitialize( const char* database );
    long long timeGet();
    int acceptWithTimeout( int          serverSocket,
                          struct sockaddr_in* clientInternetAddress,
                          struct timeval  timeout);
    Array< TransferRecord *> transferRecords;
    pthread_mutex_t controlMutex;
    int id;
    TransferEngineCallbackInterface* transferEngineCallbackInterface;
    AlioSession alioSession;
    pthread_t senderThread;
    char* pathBase;
};
#endif
// Computer Program Listing Appendix Under 37 CFR 1.52(e)
// client_info.cpp
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#include <client_info.h>
#include <time.h>
#include <log.h>
#define CLIENT_INFO_QUERY_MAXSIZE      1000
#define CLIENT_INFO_TABLE_NAME         "client_info"
#define CLIENT_INFO_TABLE_FIELD_COUNT  26
#define CLIENT_CONTACT_TIMEOUT_BASE    300
#define CLIENT_CONTACT_TIMEOUT_VARIANCE 60
#define CLIENT_INFO_FREESPACE          2000000000LL
#define CLIENT_INFO_WATCHABLE_MAX      20
#define CLIENT_INFO_NORMS_MAX          100
#define CLIENT_INFO_HIGH_MAX           1000
AlioError ClientInfo::TableConfirm( AlioSession* alioSession )
{
    AlioError error;
    error = alioSession->execute( "SELECT * FROM "
                                CLIENT_INFO_TABLE_NAME
                                " LIMIT 1;" );
    bool create = ( error != ALIO_OK );
    if ( error == ALIO_OK )
    {
        int fields;
        alioSession->resultsGet();
        alioSession->resultFieldCountGet( &fields );
        if ( fields != CLIENT_INFO_TABLE_FIELD_COUNT )
        {
            alioSession->dropTable( CLIENT_INFO_TABLE_NAME );
            create = true;
        }
    }
}

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    alioSession->resultsFree();
}
if ( create )
{
    error = alioSession->execute( "CREATE TABLE " CLIENT_INFO_TABLE_NAME
        " ( id INT PRIMARY KEY,"
        "   ip_address VARCHAR( 100 ),"
        "   ip_message_port INT,"
        "   ip_transfer_port INT,"
        "   customer_id INT,"
        "   uplink_capacity INT,"
        "   uplink_current INT,"
        "   uplink_last INT,"
        "   downlink_capacity INT,"
        "   downlink_current INT,"
        "   downlink_last INT,"
        "   storage_capacity BIGINT,"
        "   storage_current BIGINT,"
        "   media_unwatched_count INT,"
        "   media_available_count INT,"
        "   media_list_size INT,"
        "   media_out_time BIGINT,"
        "   media_requested_time BIGINT,"
        "   media_touched INT,"
        "   connected INT,"
        "   contact_last BIGINT,"
        "   contact_timeout BIGINT,"
        "   passive INT, "
        "   preloading INT, "
        "   server INT, "
        "   simulated INT,"
        "   INDEX i1 ( media_unwatched_count ),"
        "   INDEX i2 ( downlink_last ),"
        " );" );
    if ( error != ALIO_OK )
        return error;
}
return ALIO_OK;
}

AlioError ClientInfo::TableDrop( AlioSession* alioSession )
{
    alioSession->dropTable( CLIENT_INFO_TABLE_NAME );
    alioSession->idReset( CLIENT_INFO_TABLE_NAME );
    return ALIO_OK;
}

AlioError ClientInfo::SamplesCreate( AlioSession* alioSession, int base, int count )
{
    alioSession->transactionStart();
    for ( int i = 0; i < count; i++ )
    {

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char ip[ 100 ];
ClientInfo *ci = new ClientInfo( alioSession );
sprintf( ip, "www.ipaddress_%d_%d.com", base, i );
ci->ipAddressSet( ip );
ci->ipMessagePortSet( 10000 );
ci->ipMessagePortSet( 10001 );
ci->ipTransferPortSet( 10001 );
ci->customerIdSet( i );
ci->uplinkCapacitySet( 128000 );
ci->uplinkCurrentSet( 0 );
ci->uplinkLastSet( 0 );
ci->downlinkCapacitySet( 1000000 );
ci->downlinkCurrentSet( 0 );
ci->downlinkLastSet( 0 );
ci->storageCapacitySet( 40000000 );
ci->storageCurrentSet( 0 );
ci->connectedSet( false );
ci->contactLastSet( 0 );
ci->mediaUnwatchedCountSet( 0 );
ci->mediaAvailableCountSet( 0 );
ci->mediaListSizeSet( 0 );
ci->mediaTouchedSet( true );
ci->mediaOutTimeSet( 0 );
ci->mediaRequestedTimeSet( 0 );
ci->contactTimeoutSet( time( 0 ) + ( rand() % 60 ) + ( rand() % 60 ) );
ci->passiveSet( false );
}
alioSession->transactionEnd();
return ALIO_OK;
}

ClientInfo* ClientInfo::Find( AlioSession* alioSession, int id )
{
    // first need to see if the object is already loaded
    ClientInfo* ci;
    if ( ( ci = FindFromCache( alioSession, id ) ) )
        return ci;
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT * from " CLIENT_INFO_TABLE_NAME " WHERE id =
%d;", id );
    AlioError status;
    status = alioSession->execute( q );
    if ( status != ALIO_OK )
        return 0;
    status = alioSession->resultsGet();
    if ( status != ALIO_OK )
        return 0;
    long long count;
    alioSession->resultCountGet( &count );
    if ( count == 1 )
    {

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ci = new ClientInfo( alioSession, id );
int fieldCount;
alioSession->resultFieldCountGet( &fieldCount );
AlioError status = ci->loadDBObject( alioSession->resultRowGet(), fieldCount );
alioSession->resultsFree();
if ( status == ALIO_OK )
{
    //if ( alioSession->transactionActive() )
    // alioSession->clientInfosGet()->append( mi );
    return ci;
}
else
    return 0;
}
else
{
    alioSession->resultsFree();
    return 0;
}
}

Array< ClientInfo * >* ClientInfo::FindByContactTimeout( Array< ClientInfo *>* results, AlioSession* alioSession, long
long time )
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT * from " CLIENT_INFO_TABLE_NAME " WHERE
contact_timeout < %lld;", time );
    return FindByQuery( results, alioSession, q );
}

Array< ClientInfo* >* ClientInfo::FindTopPriorityDownload( Array< ClientInfo *>* results, AlioSession* alioSession )
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT * from " CLIENT_INFO_TABLE_NAME
        " WHERE media_unwatched_count = 0 AND "
        "     media_list_size > 0 AND "
        "     downlink_current = 0 AND "
        "     connected = 1 AND "
        "     server = 0 AND "
        "     storage_capacity - storage_current > %lld "
        " ORDER BY media_out_time"
        " LIMIT %d ;", CLIENT_INFO_FREESPACE, CLIENT_INFO_HIGH_MAX );
    return FindByQuery( results, alioSession, q );
}

Array< ClientInfo* >* ClientInfo::FindNormalPriorityDownload( Array< ClientInfo *>* results, AlioSession* alioSession )
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT * from " CLIENT_INFO_TABLE_NAME
        " WHERE downlink_current = 0 AND "
        "     server = 0 AND "
        "     media_available_count < %d AND "
        "     media_list_size > media_available_count AND "

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        "    connected = 1 AND "
        "    storage_capacity - storage_current > %lld "
        " ORDER BY downlink_last"
        " LIMIT %d ;", CLIENT_INFO_WATCHABLE_MAX, CLIENT_INFO_FREESPACE,
CLIENT_INFO_NORMS_MAX );
    return FindByQuery( results, alioSession, q );
}
Array< ClientInfo* >* ClientInfo::FindMediaSource( Array< ClientInfo* >* results, AlioSession* alioSession, int
medialtemId, bool p2pEnable, bool serverEnable, bool avoidPassive )
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    char *tweak1;
    char *tweak2;
    if ( p2pEnable )
    {
        if ( serverEnable )
            tweak1 = "";
        else
            tweak1 = " AND " CLIENT_INFO_TABLE_NAME ".server = 0 ";
    }
    else
    {
        if ( serverEnable )
            tweak1 = " AND " CLIENT_INFO_TABLE_NAME ".server = 1 ";
        else
        {
            results->empty();
            return results;
        }
    }
    if ( avoidPassive )
        tweak2 = " AND " CLIENT_INFO_TABLE_NAME ".passive = 0 ";
    else
        tweak2 = "";
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT " CLIENT_INFO_TABLE_NAME ".* from "
CLIENT_INFO_TABLE_NAME " , " CLIENT_MEDIA_TABLE_NAME
        " WHERE " CLIENT_INFO_TABLE_NAME ".id = " CLIENT_MEDIA_TABLE_NAME
".client_id AND"
        "    " CLIENT_MEDIA_TABLE_NAME ".media_id = %d AND"
        "    " CLIENT_MEDIA_TABLE_NAME ".complete = 1 AND"
        "    " CLIENT_INFO_TABLE_NAME ".uplink_current < uplink_capacity"
        "    %s "
        "    %s "
        " ORDER BY " CLIENT_INFO_TABLE_NAME ".uplink_last "
        " LIMIT 1;",
        medialtemId,
        tweak1,
        tweak2 );
    return FindByQuery( results, alioSession, q );
}

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Array< ClientInfo* >* ClientInfo::FindServers( Array< ClientInfo *>* results, AlioSession* alioSession )
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE, "SELECT * from " CLIENT_INFO_TABLE_NAME
            " WHERE server = 1"
            " AND connected = 1;" );
    return FindByQuery( results, alioSession, q );
}

Array< ClientInfo * >* ClientInfo::FindByQuery( Array< ClientInfo *>* results, AlioSession* alioSession, char* q )
{
    AlioError status;
    status = alioSession->execute( q );
    if ( status != ALIO_OK )
        return results;
    status = alioSession->resultsGet();
    if ( status != ALIO_OK )
        return results;
    long long count;
    alioSession->resultCountGet( &count );
    int fieldCount;
    alioSession->resultFieldCountGet( &fieldCount );
    if ( fieldCount == CLIENT_INFO_TABLE_FIELD_COUNT && count > 0 )
    {
        if ( results == 0 )
            results = new Array< ClientInfo *>;
        else
            results->empty();
        for ( int i = 0; i < count; i++ )
        {
            char** resultRow = alioSession->resultRowGet();
            int resultId;
            sscanf( resultRow[ 0 ], "%d", &resultId );
            ClientInfo* m = FindFromCache( alioSession, resultId );
            if ( m == 0 )
            {
                m = new ClientInfo( alioSession, resultId );
                m->loadDBObject( resultRow, fieldCount );
            }
            results->append( m );
        }
    }
    alioSession->resultsFree();
    return results;
}

ClientInfo* ClientInfo::FindFromCache( AlioSession* alioSession, int id )
{
    Array< ClientInfo* >* cs = alioSession->clientInfoGet();
    for ( int i = 0; i < cs->sizeGet(); i++ )
    {
        ClientInfo* c = cs->elementGet( i );
    }
}

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    if ( c->idGet() == id )
        return c;
    }
    return 0;
}

ClientInfo::ClientInfo( AlioSession* alioSessionInit ) : DataObject( alioSessionInit )
{
    int idNext;
    init();
    alioSession = alioSessionInit;
    alioSession->idGet( CLIENT_INFO_TABLE_NAME, 1, &idNext );
    idSet( idNext );
    if ( alioSession->transactionActive() )
        alioSession->clientInfoGet()->append( this );
}

ClientInfo::ClientInfo( AlioSession* alioSessionInit, int idInit ) : DataObject( alioSessionInit )
{
    init();
    alioSession = alioSessionInit;
    idSet( idInit );
    if ( alioSession->transactionActive() )
        alioSession->clientInfoGet()->append( this );
}

void ClientInfo::init()
{
    server = 0;
    ipAddress = 0;
    ipMessagePort = 0;
    ipTransferPort = 0;
    customerId = -1;
    uplinkCapacity = 0;
    uplinkCurrent = 0;
    uplinkLast = 0;
    downlinkCapacity = 0;
    downlinkCurrent = 0;
    downlinkLast = 0;
    storageCapacity = 0;
    storageCurrent = 0;
    connected = 0;
    contactLast = 0;
    contactTimeout = 0;
    passive = 0;
    mediaUnwatchedCount = 0;
    mediaAvailableCount = 0;
    mediaListSize = 0;
    mediaOutTime = 0;
    mediaRequestedTime = 0;
    mediaTouched = 0;
    mediaList = 0;
    preloading = true;
}

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    simulated = false;
}
ClientInfo::~ClientInfo()
{
    if ( ipAddress != 0 )
        free( ipAddress );
    alioSession->deletingObject( this );
}
AlioError ClientInfo::createDBObject()
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE,
        "INSERT INTO " CLIENT_INFO_TABLE_NAME " SET"
        " id = %d,"
        " ip_address = \"%s\","
        " ip_message_port = %d, "
        " ip_transfer_port = %d, "
        " customer_id = %d, "
        " uplink_capacity = %d,"
        " uplink_current = %d,"
        " uplink_last = %lld,"
        " downlink_capacity = %d,"
        " downlink_current = %d,"
        " downlink_last = %lld,"
        " storage_capacity = %lld,"
        " storage_current = %lld,"
        " media_unwatched_count = %d,"
        " media_available_count = %d,"
        " media_list_size = %d,"
        " media_out_time = %lld,"
        " media_requested_time = %lld,"
        " media_touched = %d,"
        " connected = %d,"
        " contact_last = %lld,"
        " contact_timeout = %lld,"
        " passive = %d,"
        " preloading = %d,"
        " server = %d,"
        " simulated = %d ;",
        idGet(),
        ipAddress, ipMessagePort, ipTransferPort,
        customerId,
        uplinkCapacity, uplinkCurrent, uplinkLast,
        downlinkCapacity, downlinkCurrent, downlinkLast,
        storageCapacity, storageCurrent,
        mediaUnwatchedCount, mediaAvailableCount,
        mediaListSize,
        mediaOutTime,
        mediaRequestedTime,
        mediaTouched,

```

```

        connected, contactLast, contactTimeout,
        passive,
        preloading,
        server,
        simulated );
// printf( "CLIENT INFO INSERT QUERY \n %s \n", q );
return alioSession->execute( q );
}
AlioError ClientInfo::deleteDBObject()
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE,
        "DELETE FROM " CLIENT_INFO_TABLE_NAME " WHERE"
        " id = %d;", idGet() );
    return alioSession->execute( q );
}
AlioError ClientInfo::updateDBObject()
{
    char q[ CLIENT_INFO_QUERY_MAXSIZE ];
    snprintf( q, CLIENT_INFO_QUERY_MAXSIZE,
        "UPDATE " CLIENT_INFO_TABLE_NAME " SET"
        " ip_address = \"%s\","
        " ip_message_port = %d, "
        " ip_transfer_port = %d, "
        " customer_id = %d, "
        " uplink_capacity = %d,"
        " uplink_current = %d,"
        " uplink_last = %lld,"
        " downlink_capacity = %d,"
        " downlink_current = %d,"
        " downlink_last = %lld,"
        " storage_capacity = %lld,"
        " storage_current = %lld,"
        " media_unwatched_count = %d,"
        " media_available_count = %d,"
        " media_list_size = %d,"
        " media_out_time = %lld,"
        " media_requested_time = %lld,"
        " media_touched = %d,"
        " connected = %d,"
        " contact_last = %lld,"
        " contact_timeout = %lld,"
        " passive = %d, "
        " preloading = %d, "
        " server = %d,"
        " simulated = %d "
        " WHERE id = %d;",
        ipAddress,
        ipMessagePort,
        ipTransferPort,

```

```

        customerId,
        uplinkCapacity,
        uplinkCurrent,
        uplinkLast,
        downlinkCapacity,
        downlinkCurrent,
        downlinkLast,
        storageCapacity, storageCurrent,
        mediaUnwatchedCount, mediaAvailableCount,
        mediaListSize,
        mediaOutTime,
        mediaRequestedTime,
        mediaTouched,
        connected, contactLast, contactTimeout,
        passive,
        preloading,
        server,
        simulated,
        idGet() );
return alioSession->execute( q );
}
AlioError ClientInfo::loadDBObject( char** row, int fieldCount )
{
    if ( fieldCount == CLIENT_INFO_TABLE_FIELD_COUNT )
    {
        long long idInit;
        sscanf( row[ 0 ], "%lld", &idInit );
        idSet( idInit );
        if ( ipAddress )
            free( ipAddress );
        if ( row[ 1 ] )
            ipAddress = strdup( row[ 1 ] );
        sscanf( row[ 2 ], "%d", &ipMessagePort );
        sscanf( row[ 3 ], "%d", &ipTransferPort );
        sscanf( row[ 4 ], "%d", &customerId );
        sscanf( row[ 5 ], "%d", &uplinkCapacity );
        sscanf( row[ 6 ], "%d", &uplinkCurrent );
        sscanf( row[ 7 ], "%lld", &uplinkLast );
        sscanf( row[ 8 ], "%d", &downlinkCapacity );
        sscanf( row[ 9 ], "%d", &downlinkCurrent );
        sscanf( row[ 10 ], "%lld", &downlinkLast );
        sscanf( row[ 11 ], "%lld", &storageCapacity );
        sscanf( row[ 12 ], "%lld", &storageCurrent );
        sscanf( row[ 13 ], "%d", &mediaUnwatchedCount );
        sscanf( row[ 14 ], "%d", &mediaAvailableCount );
        sscanf( row[ 15 ], "%d", &mediaListSize );
        sscanf( row[ 16 ], "%lld", &mediaOutTime );
        sscanf( row[ 17 ], "%lld", &mediaRequestedTime );
        int mediaTouchedInit;
        sscanf( row[ 18 ], "%d", &mediaTouchedInit );
    }
}

```

```

int connectedInit;
sscanf( row[ 19 ], "%d", &connectedInit );
connected = connectedInit != 0;
sscanf( row[ 20 ], "%lld", &contactLast );
sscanf( row[ 21 ], "%lld", &contactTimeout );
int passivelInit;
sscanf( row[ 22 ], "%d", &passivelInit );
passive = passivelInit != 0;
int preloadingInit;
sscanf( row[ 23 ], "%d", &preloadingInit );
preloading = preloadingInit != 0;
int serverInit;
sscanf( row[ 24 ], "%d", &serverInit );
server = serverInit != 0;
int simulatedInit;
sscanf( row[ 25 ], "%d", &simulatedInit );
simulated = simulatedInit != 0;
cleanSet();
return ALIO_OK;
}
else
    return ALIO_ERROR_BAD_VALUE;
}

void ClientInfo::mediaProcess( long long time )
{
    // load the client media
    mediaListConfirm();
    mediaUnwatchedCountSet( mediaList->mediaUnwatchedCountGet() );
    mediaAvailableCountSet( mediaList->mediaAvailableCountGet() );
    mediaListSizeSet( mediaList->sizeGet() );
    storageCurrentSet( mediaList->storageCurrentGet() );
    // assign a time at which the media count goes to zero
    if ( mediaUnwatchedCountGet() == 0 && mediaOutTimeGet() == 0 && mediaListSizeGet() > 0 )
        mediaOutTimeSet( time );
    mediaTouchedSet( false );
}

int ClientInfo::mediaItemForDownloadNextGet()
{
    mediaListConfirm();
    return mediaList->mediaItemForDownloadNextGet();
}

//
// INDIRECT GETTERS
//
void ClientInfo::mediaListConfirm()
{
    if ( mediaList == 0 )
        mediaList = new ClientMediaList( alioSession, idGet() );
}

ClientMedia* ClientInfo::clientMediaNew( int mediaId, bool requested, int rank )

```

```

{
    Log::L( alioSession, 3, "ClientCore", "New ClientMedia", "MediaId %d Requested %d Rank %d", mediaId, requested,
rank );
    mediaListConfirm();
    return mediaList->add( mediaId, requested, rank );
}
void ClientInfo::clientMediaComplete( int mediaId )
{
    Log::L( alioSession, 3, "ClientCore", "ClientMedia Complete", "MediaId %d", mediaId );
    mediaListConfirm();
    return mediaList->completeSet( mediaId );
}
int ClientInfo::clientMediaIdForMediaIdGet( int mediaInId )
{
    mediaListConfirm();
    return mediaList->clientMediaIdForMediaIdGet( mediaInId );
}
ClientMedia* ClientInfo::clientMediaGetFromMediaId( int mediaInId )
{
    mediaListConfirm();
    return mediaList->clientMediaGetFromMediaId( mediaInId );
}
void ClientInfo::clientMediaMove( int rankOld, int rankNew )
{
    mediaListConfirm();
    mediaList->move( rankOld, rankNew );
}
void ClientInfo::clientMediaRemove( int rank )
{
    mediaListConfirm();
    mediaList->remove( rank );
    mediaProcess( timeGet() );
}
void ClientInfo::clientMediaAdd( int rank, int mediaId )
{
    mediaListConfirm();
    mediaList->add(mediaId, true, rank );
    mediaProcess( timeGet() );
}
//
// GETTERS AND SETTERS
//
void ClientInfo::ipAddressSet( const char* ipAddressInit )
{
    if ( ipAddress != NULL )
        free( ipAddress );
    ipAddress = strdup( ipAddressInit );
    dirtySet();
}
char* ClientInfo::ipAddressGet()

```

```

{
    return ipAddress;
}
void ClientInfo::uplinkCapacitySet( int uplinkCapacityInit )
{
    uplinkCapacity = uplinkCapacityInit;
    dirtySet();
}
int ClientInfo::uplinkCapacityGet()
{
    return uplinkCapacity;
}
void ClientInfo::uplinkCurrentSet( int uplinkCurrentInit )
{
    uplinkCurrent = uplinkCurrentInit;
    dirtySet();
}
int ClientInfo::uplinkCurrentGet()
{
    return uplinkCurrent;
}
void ClientInfo::downlinkCapacitySet( int downlinkCapacityInit )
{
    downlinkCapacity = downlinkCapacityInit;
    dirtySet();
}
int ClientInfo::downlinkCapacityGet()
{
    return downlinkCapacity;
}
void ClientInfo::downlinkCurrentSet( int downlinkCurrentInit )
{
    downlinkCurrent = downlinkCurrentInit;
    dirtySet();
}
int ClientInfo::downlinkCurrentGet()
{
    return downlinkCurrent;
}
void ClientInfo::storageCapacitySet( long long storageCapacityInit )
{
    storageCapacity = storageCapacityInit;
    dirtySet();
}
long long ClientInfo::storageCapacityGet()
{
    return storageCapacity;
}
void ClientInfo::storageCurrentSet( long long storageCurrentInit )
{

```

```

    storageCurrent = storageCurrentInit;
    dirtySet();
}
long long ClientInfo::storageCurrentGet()
{
    return storageCurrent;
}
void ClientInfo::connectedSet( bool connectedInit )
{
    connected = connectedInit;
    dirtySet();
}
bool ClientInfo::connectedGet()
{
    return connected;
}
void ClientInfo::contactLastSet( long long contactLastInit )
{
    contactLast = contactLastInit;
    dirtySet();
}
long long ClientInfo::contactLastGet()
{
    return contactLast;
}
void ClientInfo::contactTimeoutSet( long long contactTimeoutInit )
{
    contactTimeout = contactTimeoutInit;
    dirtySet();
}
long long ClientInfo::contactTimeoutGet()
{
    return contactTimeout;
}
void ClientInfo::passiveSet( bool passiveInit )
{
    passive = passiveInit;
    dirtySet();
}
bool ClientInfo::passiveGet()
{
    return passive;
}
// scheduler.cpp
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#include "scheduler.h"
#include "stdio.h"
#include "sys/time.h"
#include "time.h"
#define RESOLUTION          1000

```

```

#define SCHEDULER_ID -1
#define SCHEDULER_CLIENT_CONTACT_TIMEOUT ( 35 * 60 )
#define SCHEDULER_STRING_SIZE 1000
#define SCHEDULER_CUSTOMER_COUNT_MAX 10000
#define SCHEDULER_SPAWN_QUICK_INTERVAL 4
#define SCHEDULER_SPAWN_COUNT 100
#define SCHEDULER_CUSTOMER_LIST_SIZE 12
#define SCHEDULER_MEDIA_COUNT 34
#define SCHEDULER_MESSAGE_RETRIES 3
#define SCHEDULER_TRANSFER_SIZE ( 2000000000LL / 10 )
#define SCHEDULER_TRANSFER_TIMEOUT ( 3 * 60 )
#define SCHEDULER_TRANSFER_COUNT_MAX 50
#define SCHEDULER_CLIENT_DOWNLINK_DEFAULT 1000000
#define SCHEDULER_CLIENT_UPLINK_DEFAULT 128000
#define SCHEDULER_SERVER_DOWNLINK_DEFAULT 45000000
#define SCHEDULER_SERVER_UPLINK_DEFAULT 45000000
// #define SCHEDULER_SERVER_DOWNLINK_DEFAULT 5000000
// #define SCHEDULER_SERVER_UPLINK_DEFAULT 5000000
#define SCHEDULER_MEDIA_AUTHORIZATION_TIME (10 * 60)
// #define SCHEDULER_MEDIA_AUTHORIZATION_TIME (48 * 60 * 60)
#define SCHEDULER_WATCHABLE_MAX 12
#define SCHEDULER_MEDIA_COST ( 4.5 )
Scheduler* theScheduler;
void* threadRunCall( void* )
{
    theScheduler->threadRunning();
    return NULL;
}
Scheduler::Scheduler( int init )
{
    uiInterface = NULL;
    running = false;
    theScheduler = this;
    ipPort = 0;
    customerSpawnLast = 0;
    customerCount = 0;
    p2pEnable = false;
    serverEnable = false;
    // Create the mutex
    pthread_mutex_init( &runningMutex, NULL );
    databaseInitialize( init );
    messageEngine = new MessageEngine( SCHEDULER_ID, "alio_scheduler" );
    srand( timeGet() );
    transferPriority = false;
}
void Scheduler::uiInterfaceSet( SchedulerUIInterface* uiInterfaceInit )
{
    uiInterface = uiInterfaceInit;
}
void Scheduler::run()

```

```

{
    if ( !running )
    {
        Log::LT( &alioSession, 3, "Scheduler", "RUN", "Run command issued from UI" );
        uiInterface->logUpdate();
        running = true;
        printf( " running with port %d\n", ipPort );
        messageEngine->listeningPortSet( ipPort );
        messageEngine->run();
        // Fire up the input thread
        pthread_create( &runningThread, NULL, threadRunCall, NULL );
    }
}

void Scheduler::stop()
{
    if ( running )
    {
        Log::LT( &alioSession, 3, "Scheduler", "STOP", "Stop command issued from UI" );
        uiInterface->logUpdate();
        messageEngine->stop();
        running = false;
    }
}

void Scheduler::p2pEnableSet( bool enable )
{
    p2pEnable = enable;
}

void Scheduler::serverEnableSet( bool enable )
{
    serverEnable = enable;
}

long long Scheduler::timeGet()
{
    return time( 0 );
}

void Scheduler::threadRunning( )
{
    struct timeval timeStart;
    struct timeval timeEnd;
    struct timeval timeDifference;
    printf( "RUNNING\n" );
    running = true;
    while ( running )
    {
        gettimeofday( &timeStart, NULL );
        iterate( timeGet() );
        gettimeofday( &timeEnd, NULL );
        timeSubtract( &timeDifference, &timeStart, &timeEnd );
        long long us = timeDifference.tv_sec * 1000000 + timeDifference.tv_usec;
        // printf( " Took %ldms\n", us / 1000 );
    }
}

```

```

long long overrun = us - ( RESOLUTION * 1000 );
if ( overrun <= 0 )
{
    usleep( ( RESOLUTION * 1000 ) - us );
    // printf( "    Took %lldms\n", us / 1000 );
}
else
    printf( "    Overran time by %lldms\n", overrun / 1000 );
// seconds+= RESOLUTION/1000;
uiInterface->timeUpdate();
}
printf( "STOPPED\n" );
}

void Scheduler::iterate( long long seconds )
{
    bool logRefresh = false;
    bool messageRefresh = false;
    bool clientInfoRefresh = false;
// printf ( "Iterate %lld\n", seconds );
// Do a bunch of stuff - each one in it's own transaction
// initiate transfers - alternate high and low priority
transfersDesign( transferPriority );
transferPriority = !transferPriority;
// Check on any wayward transfers
transfersMonitor( seconds );
// Check on any wayward messages
messagesMonitor( seconds );
alioSession.transactionStart();
if ( customerCount < SCHEDULER_CUSTOMER_COUNT_MAX && seconds > customerSpawnLast +
SCHEDULER_SPAWN_QUICK_INTERVAL )
{
    for ( int i = 0; i < SCHEDULER_SPAWN_COUNT; i++ )
        customerNewCreate( );
    customerSpawnLast = seconds;
}
alioSession.transactionEnd();
alioSession.transactionStart();
printf( "Scheduler: Messages " );
Array< Message* > ms;
messageEngine->messagesReceiveByReceiver( &alioSession, &ms, SCHEDULER_ID );
printf("Count %d\n", ms.sizeGet() );
if ( ms.sizeGet() > 0 )
{
    //printf( "    %d Incoming Messages\n", ms.sizeGet() );
    for ( int i = 0; i < ms.sizeGet(); i++ )
    {
        Message* m = ms.elementGet( i );
        //printf( "    %d: %s\n", i, m->messageGet() );
        Log::L( &alioSession, 3, "Scheduler", "Message In", m->messageGet() );
        processMessage( m );
    }
}

```

```

        m->deleteObject();
        logRefresh = true;
        messageRefresh = true;
    }
}
alioSession.transactionEnd();
//printf( " Check Status\n" );
alioSession.transactionStart();
Array< ClientInfo* > cis;
ClientInfo::FindByContactTimeout( &cis, &alioSession, seconds );
if ( cis.sizeGet() > 0 )
{
    printf( "   %d Clients Timedout\n", cis.sizeGet() );
    for ( int i = 0; i < cis.sizeGet(); i++ )
    {
        ClientInfo* ci = cis.elementGet( i );
        printf( "       %d: ClientId %d : Timeout %lld\n", i, ci->idGet( ), ci->contactTimeoutGet( ) );
        if ( !ci->passiveGet( ) )
        {
            ci->contactTimeoutSet( seconds + SCHEDULER_CLIENT_CONTACT_TIMEOUT );
            ci->connectedSet( false );
            Message* m = new Message( );
            m->toldSet( ci->idGet( ) );
            m->fromIdSet( SCHEDULER_ID );
            m->messageSet( "contactPassive( );" );
            m->timestampSet( seconds );
            messageEngine->messageSend( &alioSession, m );
            Log::L( &alioSession, 3, "Scheduler", "Message Out", m->messageGet( ) );
            logRefresh = true;
            clientInfoRefresh = true;
        }
    }
}
alioSession.transactionEnd();
// do a search for clients with under populated boxes - sort by how bad it is
/*
if ( logRefresh )
    uiInterface->logUpdate();
if ( messageRefresh )
    uiInterface->messageUpdate();
if ( clientInfoRefresh )
    uiInterface->clientInfoUpdate();
*/
}

bool Scheduler::transfersDesign( bool topPriority )
{
    if ( !p2pEnable && !serverEnable )
    {
        return false;
    }
}

```

```

// Each one in a transaction?
alioSession.transactionStart();
Array< ClientInfo* > desparados;
if ( topPriority )
{
    printf( "Scheduler: Downloads High Priority " );
    ClientInfo::FindTopPriorityDownload( &desparados, &alioSession );
}
else
{
    printf( "Scheduler: Downloads Low Priority " );
    ClientInfo::FindNormalPriorityDownload( &desparados, &alioSession );
}
int count = desparados.sizeGet();
printf("Count %d\n", count );
if ( count > 0 )
{
    printf( "    %d Clients Ready For Media %s\n", count, ( topPriority ? "High Priority" : "Low Priority" ) );
    for ( int i = 0; i < desparados.sizeGet(); i++ )
    {
        ClientInfo* receiver = desparados.elementGet( i );
        printf( "    ClientId %d ", receiver->idGet( ) );
        // Find a media item
        int nextMediaItem = receiver->mediaItemForDownloadNextGet();
        if ( nextMediaItem != -1 )
        {
            printf( " Media Item %d ", nextMediaItem );
            // Find a donor
            Array< ClientInfo* > suppliers;
            if ( receiver->preloadingGet( ) )
                ClientInfo::FindServers( &suppliers, &alioSession );
            else
            {
                // ensure that if the receiver is a "passive" i.e. can not receive calls, can't chose a donor that is "passive" too
                ClientInfo::FindMediaSource( &suppliers, &alioSession, nextMediaItem, p2pEnable, serverEnable, receiver-
>passiveGet( ) );
            }
            if ( suppliers.sizeGet() > 0 )
            {
                ClientInfo *sender = suppliers.elementGet( 0 );
                // need to confirm that the sender has still got bandwidth
                // might have been committed in a previous loop
                printf( " Sender %d ", sender->idGet( ) );
                // Find the actual client media record for the receiver
                ClientMedia *cm = receiver->clientMediaGetFromMediaId( nextMediaItem );
                // Set the flag in Client Media to signal downloading
                cm->downloadingSet( cm->downloadingGet( ) + 1 );
                // Make a transfer record
                Transfer* transfer = new Transfer( &alioSession );
                transfer->toClientIdSet( receiver->idGet( ) );
            }
        }
    }
}

```

```

transfer->fromClientIdSet( sender->idGet() );
transfer->mediaIdSet( nextMediaItem );
transfer->transferByteStartSet( cm->sizeCurrentGet() );
transfer->transferByteCurrentSet( cm->sizeCurrentGet() );
transfer->toContactProcess( timeGet(), SCHEDULER_TRANSFER_TIMEOUT );
transfer->fromContactProcess( timeGet(), SCHEDULER_TRANSFER_TIMEOUT );
long long remainingSize = cm->sizeGet() - cm->sizeCurrentGet();
long long transferSize = ( remainingSize < SCHEDULER_TRANSFER_SIZE ) ? remainingSize :
SCHEDULER_TRANSFER_SIZE;
transfer->transferByteLengthSet( transferSize );
// Send the transfer start message to the clients
// Arg 0 = "transferStart"
// Arg 1 = scheduler transfer id
// Arg 2 = remote id
// Arg 3 = remote ip address
// Arg 4 = remote transfer port
// Arg 5 = media id
// Arg 6 = active
// Arg 7 = sending
// Arg 8 = start byte
// Arg 9 = length
char t[ SCHEDULER_STRING_SIZE ];
Message* mr = new Message( );
mr->toldSet( receiver->idGet() );
mr->fromIdSet( SCHEDULER_ID );
mr->passiveSendSet( receiver->passiveGet() );
snprintf( t, SCHEDULER_STRING_SIZE, "transferStart( %d, %d, %s, %d, %d, %d, %d, %lld, %lld )",
transfer->idGet(), sender->idGet(), sender->ipAddressGet(), sender->ipTransferPortGet(),
nextMediaItem, receiver->passiveGet(), 0,
transfer->transferByteStartGet(), transfer->transferByteLengthGet() );
mr->messageSet( t );
messageEngine->messageSend( &alioSession, mr );
Message* ms = new Message( );
ms->toldSet( sender->idGet() );
ms->fromIdSet( SCHEDULER_ID );
ms->passiveSendSet( sender->passiveGet() );
snprintf( t, SCHEDULER_STRING_SIZE, "transferStart( %d, %d, %s, %d, %d, %d, %d, %lld, %lld )",
transfer->idGet(), receiver->idGet(), receiver->ipAddressGet(), receiver->ipTransferPortGet(),
nextMediaItem, !receiver->passiveGet(), 1,
transfer->transferByteStartGet(), transfer->transferByteLengthGet() );
ms->messageSet( t );
messageEngine->messageSend( &alioSession, ms );
// Get the likely download utilization
int uplinkRateMax = sender->uplinkCapacityGet() - sender->uplinkCurrentGet();
int downlinkRateMax = receiver->downlinkCapacityGet() - receiver->downlinkCurrentGet();
int transferRate = ( uplinkRateMax < downlinkRateMax ) ? uplinkRateMax : downlinkRateMax;
transfer->transferRateIdealSet( transferRate );
// preloads don't load the server - see processMessageTransferComplete() & transferAbort() for the opposite
if ( !( sender->serverGet() && receiver->preloadingGet() ) )
sender->uplinkCurrentSet( sender->uplinkCurrentGet() + transferRate );

```

```

        receiver->downlinkCurrentSet( receiver->downlinkCurrentGet() + transferRate );
        // Other stuff to do?
    }
}
printf( "\n" );
}
}
alioSession.transactionEnd();
return count < SCHEDULER_TRANSFER_COUNT_MAX;
}

void Scheduler::transfersMonitor( long long time )
{
    alioSession.transactionStart();
    Array <Transfer*> transfers;
    Transfer::FindByContactTimeout( &transfers, &alioSession, time );
    int count = transfers.sizeGet();
    for ( int i = 0; i < count; i++ )
    {
        Transfer *transfer = transfers.elementGet( i );
        // clobber it
        transferAbort( transfer );
        transfer->deleteObject();
    }
    alioSession.transactionEnd();
}

void Scheduler::messagesMonitor( long long UNUSED time )
{
    alioSession.transactionStart();
    Array <Message*> messages;
    Message::FindByRetriedOut( &messages, &alioSession, SCHEDULER_ID, SCHEDULER_MESSAGE_RETRIES );
    int count = messages.sizeGet();
    for ( int i = 0; i < count; i++ )
    {
        Message *message = messages.elementGet( i );
        Log::L( &alioSession, 3, "Scheduler", "Abandoning Message - too old", message->messageGet() );
        message->deleteObject();
    }
    alioSession.transactionEnd();
}

void Scheduler::transferAbort( Transfer* transfer )
{
    // specific action will depend on the state the different communicands find themselves in
    ClientInfo* sender = ClientInfo::Find( &alioSession, transfer->fromClientIdGet() );
    ClientInfo* receiver = ClientInfo::Find( &alioSession, transfer->toClientIdGet() );
    if ( sender )
    {
        // preloads don't load the server - see transferDesign( ) for the opposite
        if ( !( sender->serverGet() && receiver && receiver->preloadingGet() ) )
            sender->uplinkCurrentSet( sender->uplinkCurrentGet() - transfer->transferRateIdealGet() );
        if ( sender->connectedGet() )

```

```

{
    transferAbortMessageSend( transfer->fromClientIdGet(), transfer->idGet() );
    sender->connectedSet( false );
}
}
if ( receiver )
{
    receiver->downlinkCurrentSet( receiver->downlinkCurrentGet() - transfer->transferRateIdealGet() );
    if ( receiver->connectedGet() )
    {
        transferAbortMessageSend( transfer->toClientIdGet(), transfer->idGet() );
        receiver->connectedSet( false );
    }
}
ClientMedia *cm = ClientMedia::FindByClientIdAndMediaId( &alioSession, transfer->toClientIdGet(), transfer -
>mediaIdGet() );
if ( cm )
    cm->downloadingSet( cm->downloadingGet() - 1 );
}
void Scheduler::processMessage( Message* message )
{
    Array< char* > strings;
    message->messageParse( &strings );
    if ( strings.sizeGet() > 0 )
    {
        char* function = strings.elementGet( 0 );
        if ( strcmp( function, "clientNew" ) == 0 )
        {
            processMessageClientNew( &strings );
        }
        if ( strcmp( function, "ping" ) == 0 )
        {
            Log::L( &alioSession, 3, "Scheduler", "New Ping Message", message->messageGet() );
            processMessagePing( message->fromIdGet(), &strings );
        }
        if ( strcmp( function, "contact" ) == 0 )
        {
            Log::L( &alioSession, 3, "Scheduler", "New Contact Message", message->messageGet() );
            processMessageContact( message->fromIdGet(), &strings );
        }
        if ( strcmp( function, "clientMediaNew" ) == 0 )
        {
            Log::L( &alioSession, 3, "Scheduler", "New Client Media", message->messageGet() );
            processMessageClientMediaNew( message->fromIdGet(), &strings );
        }
        if ( strcmp( function, "clientMediaComplete" ) == 0 )
        {
            Log::L( &alioSession, 3, "Scheduler", "Client Media Complete", message->messageGet() );
            processMessageClientMediaComplete( message->fromIdGet(), &strings );
        }
    }
}

```

```

if ( strcmp( function, "transferStarting" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Starting", message->messageGet() );
    processMessageTransferStarting( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferListening" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Listening", message->messageGet() );
    processMessageTransferListening( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferConnecting" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Connecting", message->messageGet() );
    processMessageTransferConnecting( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferTransferring" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Transferring", message->messageGet() );
    processMessageTransferTransferring( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferProgress" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Progress", message->messageGet() );
    processMessageTransferProgress( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferComplete" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Complete", message->messageGet() );
    processMessageTransferComplete( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferTimeout" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Timeout", message->messageGet() );
    processMessageTransferTimeout( message->fromIdGet(), &strings );
}
if ( strcmp( function, "transferError" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "Transfer Error", message->messageGet() );
    processMessageTransferError( message->fromIdGet(), &strings );
}
if ( strcmp( function, "mediaAuthorizationRequest" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "MediaAuthorizationRequest", message->messageGet() );
    processMessageMediaAuthorizationRequest( message->fromIdGet(), &strings );
}
if ( strcmp( function, "clientMediaMove" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "ClientMediaMove", message->messageGet() );
    processMessageClientMediaMove( message->fromIdGet(), &strings );
}

```

```

if ( strcmp( function, "clientMediaRemove" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "ClientMediaRemove", message->messageGet() );
    processMessageClientMediaRemove( message->fromIdGet(), &strings );
}
if ( strcmp( function, "clientMediaAdd" ) == 0 )
{
    Log::L( &alioSession, 3, "Scheduler", "ClientMediaAdd", message->messageGet() );
    processMessageClientMediaAdd( message->fromIdGet(), &strings );
}
}
for ( int i = 0; i < strings.sizeGet(); i++ )
    free( strings.elementGet( i ) );
}

void Scheduler::processMessageClientNew( Array< char* >* arguments )
{
    // Arg 0 = "clientNew"
    // Arg 1 = client id
    // Arg 2 = server?
    // Arg 3 = simulated?
    // Arg 4 = passive?
    // Arg 5 = ip address
    // Arg 6 = ip message port
    // Arg 7 = ip transfer port
    // Arg 8 = disk capacity
    int idInit;
    sscanf( arguments->elementGet( 1 ), "%d", &idInit );
    // Try to find the record for this client
    ClientInfo *clientInfo = ClientInfo::Find( &alioSession, idInit );
    if ( clientInfo == 0 )
        clientInfo = new ClientInfo( &alioSession, idInit );
    int serverInit;
    sscanf( arguments->elementGet( 2 ), "%d", &serverInit );
    clientInfo->serverSet( ( serverInit != 0 ) );
    int simulatedInit;
    sscanf( arguments->elementGet( 3 ), "%d", &simulatedInit );
    clientInfo->simulatedSet( ( simulatedInit != 0 ) );
    int passivelInit;
    sscanf( arguments->elementGet( 4 ), "%d", &passivelInit );
    clientInfo->passiveSet( ( passivelInit != 0 ) );
    clientInfo->ipAddressSet( arguments->elementGet( 5 ) );
    int ipMessagePortInit;
    sscanf( arguments->elementGet( 6 ), "%d", &ipMessagePortInit );
    clientInfo->ipMessagePortSet( ipMessagePortInit );
    int ipTransferPortInit;
    sscanf( arguments->elementGet( 7 ), "%d", &ipTransferPortInit );
    clientInfo->ipTransferPortSet( ipTransferPortInit );
    clientInfo->customerIdSet( -1 );
    long long storageCapacityInit;
    sscanf( arguments->elementGet( 8 ), "%lld", &storageCapacityInit );

```

```

clientInfo->storageCapacitySet( storageCapacityInit );
clientInfo->contactLastSet( timeGet() );
clientInfo->contactTimeoutSet( timeGet() + SCHEDULER_CLIENT_CONTACT_TIMEOUT );
printf( "New Client Created : %d \n", clientInfo->idGet() );
// If it's a server, it doesn't get a customer id
Customer* customer = 0;
if ( !clientInfo->serverGet() )
{
    Array< Customer* > customers;
    Customer::FindByClientNew( &customers, &alioSession );
    if ( customers.sizeGet() == 0 )
    {
        Log::L( &alioSession, 3, "Scheduler", "No New Customer", "Attempting to create a new customer on demand" );
        customerNewCreate( );
        Customer::FindByClientNew( &customers, &alioSession );
        if ( customers.sizeGet() == 0 )
        {
            Log::L( &alioSession, 2, "Scheduler", "Couldn't make a new Customer", "No customer available : ignoring" );
            return;
        }
    }
    customer = customers.elementGet( 0 );
    customer->clientNewSet( customer->clientNewGet() - 1 );
    clientInfo->customerIdSet( customer->idGet() );
    clientInfo->downlinkCapacitySet( SCHEDULER_CLIENT_DOWNLINK_DEFAULT );
    clientInfo->uplinkCapacitySet( SCHEDULER_CLIENT_UPLINK_DEFAULT );
}
else
{
    clientInfo->downlinkCapacitySet( SCHEDULER_SERVER_DOWNLINK_DEFAULT );
    clientInfo->uplinkCapacitySet( SCHEDULER_SERVER_UPLINK_DEFAULT );
}
// Debugging...
// clientInfo->commitDBObject();
Message *clientConfirm = new Message( &alioSession );
clientConfirm->fromIdSet( SCHEDULER_ID );
clientConfirm->toIdSet( clientInfo->idGet() );
clientConfirm->passiveSendSet( clientInfo->passiveGet() );
char text[ 1000 ];
snprintf( text, 1000, "clientNewConfirm( %d, %s, %d, %d )", clientInfo->idGet(), ( customer != 0 ) ? customer-
>nameGet() : "SERVER", clientInfo->uplinkCapacityGet(), clientInfo->downlinkCapacityGet() );
clientConfirm->messageSet( text );
// Send Media Items
// No need to send items to the server - the simulator automagically does this
if ( clientInfo->serverGet() || !clientInfo->simulatedGet() )
{
    Array< MediaInfo* > mediaInfo;
    MediaInfo::FindByCatalog( &mediaInfo, &alioSession, 0 );
    for ( int i = 0; i < mediaInfo.sizeGet(); i++ )
    {

```

```

MediaInfo *mi = mediaInfo.elementGet( i );
// Send the info about the media item to the client
Message *m = new Message( &alioSession );
m->fromIdSet( SCHEDULER_ID );
m->toIdSet( clientInfo->idGet() );
m->passiveSendSet( clientInfo->passiveGet() );
char s[ SCHEDULER_STRING_SIZE ];
sprintf( s, "mediaInfo( %d, %d, \"%s\", \"%s\", \"%s\", \"%s\", %d, \"%s\", %lld )",
        mi->idGet(),
        mi->catalogIdGet(),
        mi->genreGet(),
        mi->titleGet(),
        mi->descriptionGet(),
        mi->directorGet(),
        mi->releaseYearGet(),
        mi->filenameGet(),
        mi->sizeGet() );
m->messageSet( s );
}
}
if ( !clientInfo->serverGet() )
{
    int clientMediaCount = 0;
    // Create Client Media Items and messages to the client for each one
    Array< CustomerMedia* > customerMedia;
    CustomerMedia::FindForNewClient( &customerMedia, &alioSession, customer->idGet() );
    int customerClientId = -1;
    for ( int i = 0; i < customerMedia.sizeGet(); i++ )
    {
        CustomerMedia *c = customerMedia.elementGet( i );
        if ( customerClientId == -1 )
            customerClientId = c->customerClientIdGet();
        // need to only do those customer media items that are for the same box
        if ( customerClientId == c->customerClientIdGet() )
        {
            clientMediaCount++;
            ClientMedia *cm = new ClientMedia( &alioSession );
            cm->clientIdSet( clientInfo->idGet() );
            cm->mediaIdSet( c->mediaIdGet() );
            cm->rankSet( c->rankGet() );
            MediaInfo* mi = MediaInfo::Find( &alioSession, c->mediaIdGet() );
            cm->sizeSet( mi->sizeGet() );
            bool complete = ( clientInfo->simulatedGet() || clientInfo->idGet() == 0 );
            cm->sizeCurrentSet( ( complete ) ? cm->sizeGet() : 0 );
            cm->completeSet( complete );
            cm->requestedSet( true );
            if ( complete )
            {
                clientInfo->storageCurrentSet( clientInfo->storageCurrentGet() + cm->sizeGet() );
                clientInfo->mediaAvailableCountSet( clientMediaCount );
            }
        }
    }
}

```

```

        clientInfo->mediaUnwatchedCountSet( clientMediaCount );
    }
    Message *m = new Message( &alioSession );
    m->fromIdSet( SCHEDULER_ID );
    m->toIdSet( clientInfo->idGet() );
    m->passiveSendSet( clientInfo->passiveGet() );
    char s[ SCHEDULER_STRING_SIZE ];
    // For testing only, if a client is simulated (or a server) let's pretend that the media is loaded already
    sprintf( s, "mediaQueue( %d, %d, %d)", c->mediaIdGet(), c->rankGet(), complete );
    m->messageSet( s );
}
clientInfo->mediaListSizeSet( clientMediaCount );
}
}
clientInfo->preloadingSet( !clientInfo->simulatedGet() );
Log::L( &alioSession, 3, "Scheduler", "New Client", text );
}
void Scheduler::processMessagePing( int fromId, Array< char* > UNUSED * arguments )
{
    // Arg 0 = "clientNew"
    // Arg 1 = ip address
    // Arg 2 = ip port
    // Look the client up
    ClientInfo* client = ClientInfo::Find( &alioSession, fromId );
    // check them!
    Message *clientConfirm = new Message( &alioSession );
    clientConfirm->fromIdSet( SCHEDULER_ID );
    clientConfirm->toIdSet( fromId );
    clientConfirm->messageSet( "pingBack( )" );
    if ( client != 0 )
        clientConfirm->passiveSendSet( client->passiveGet() );
    char s[ 10 ];
    sprintf( s, "ClientId:%d", fromId );
    Log::L( &alioSession, 3, "Scheduler", "Ping Message", s );
    printf( "Ping from %d\n", fromId );
}
void Scheduler::processMessageContact( int fromId, Array< char* > UNUSED * arguments )
{
    // Arg 0 = "contact"
    // Update the client info
    ClientInfo *clientInfo = ClientInfo::Find( &alioSession, fromId );
    if ( clientInfo != 0 )
    {
        clientInfo->contactTimeoutSet( timeGet() + SCHEDULER_CLIENT_CONTACT_TIMEOUT );
        clientInfo->connectedSet( true );
        clientInfo->contactLastSet( timeGet() );
        Log::L( &alioSession, 3, "Scheduler", "Contact Message", "ClientId:%d", fromId );
    }
    else
    {

```

```

    Log::L( &alioSession, 3, "Scheduler", "Contact Message from Unknown", "ClientId:%d", fromId );
}
}
void Scheduler::processMessageClientMediaNew( int fromId, Array< char* >* arguments )
{
    // Arg 0 = "clientMediaNew"
    // Arg 1 = mediaId
    // Arg 3 = requested
    // Arg 4 = rank
    ClientInfo *clientInfo = ClientInfo::Find( &alioSession, fromId );
    if ( clientInfo != 0 )
    {
        int mediaId = -1;
        int requestedInit = 0;
        bool requested = false;
        int rank = -1;
        sscanf( arguments->elementGet( 1 ), "%d", &mediaId );
        sscanf( arguments->elementGet( 2 ), "%d", &requestedInit );
        requested = ( requestedInit != 0 );
        sscanf( arguments->elementGet( 3 ), "%d", &rank );
        Log::L( &alioSession, 3, "Scheduler", "New Client Media Message", "MediaId:%d, Requested:%d, Rank:%d",
mediaId, requested, rank );
        clientInfo->clientMediaNew( mediaId, requested, rank );
    }
}
void Scheduler::processMessageClientMediaComplete( int fromId, Array< char* >* arguments )
{
    // Arg 0 = "clientMediaNew"
    // Arg 1 = mediaId
    ClientInfo *clientInfo = ClientInfo::Find( &alioSession, fromId );
    if ( clientInfo != 0 )
    {
        int mediaId = -1;
        sscanf( arguments->elementGet( 1 ), "%d", &mediaId );
        Log::L( &alioSession, 3, "Scheduler", "Client Media Complete", "MediaId:%d", mediaId );
        clientInfo->clientMediaComplete( mediaId );
    }
}
void Scheduler::processMessageTransferStarting( int fromId, Array< char* >* arguments )
{
    transferStateSet( fromId, Transfer::TRANSFER_STARTING, arguments );
}
void Scheduler::processMessageTransferListening( int fromId, Array< char* >* arguments )
{
    transferStateSet( fromId, Transfer::TRANSFER_LISTENING, arguments );
}
void Scheduler::processMessageTransferConnecting( int fromId, Array< char* >* arguments )
{
    transferStateSet( fromId, Transfer::TRANSFER_CONNECTING, arguments );
}
}

```

```

void Scheduler::processMessageTransferTransferring( int fromId, Array< char* >* arguments )
{
    transferStateSet( fromId, Transfer::TRANSFER_TRANSFERRING, arguments );
}
void Scheduler::processMessageTransferProgress( int fromId, Array< char* >* arguments )
{
    Transfer* transfer = transferStateSet( fromId, Transfer::TRANSFER_PROGRESS, arguments );
    if ( transfer )
    {
        //ClientInfo* receiver = ClientInfo::Find( &alioSession, transfer->toClientIdGet() );
        int localSends;
        long long bytes;
        long long seconds;
        sscanf( arguments->elementGet( 2 ), "%d", &localSends );
        sscanf( arguments->elementGet( 3 ), "%lld", &seconds );
        sscanf( arguments->elementGet( 4 ), "%lld", &bytes );
        // only bump up the count when the receiver says so
        if ( !localSends )
            transfer->transferByteCurrentSet( transfer->transferByteCurrentGet() + bytes );
    }
}
void Scheduler::processMessageTransferComplete( int fromId, Array< char* >* arguments )
{
    Transfer* transfer = transferStateSet( fromId, Transfer::TRANSFER_COMPLETE, arguments );
    if ( transfer )
    {
        if ( transfer->fromStateGet() == Transfer::TRANSFER_COMPLETE &&
            transfer->toStateGet() == Transfer::TRANSFER_COMPLETE )
        {
            Log::L( &alioSession, 3, "Scheduler", "Transfer Complete", "%d - Cleaning up", transfer->idGet() );
            ClientInfo* sender = ClientInfo::Find( &alioSession, transfer->fromClientIdGet() );
            ClientInfo* receiver = ClientInfo::Find( &alioSession, transfer->toClientIdGet() );
            // preloads don't load the server - see transferDesign( ) for the opposite
            if ( !( sender->serverGet() && receiver->preloadingGet() ) )
                sender->uplinkCurrentSet( sender->uplinkCurrentGet() - transfer->transferRateIdealGet() );
            receiver->downlinkCurrentSet( receiver->downlinkCurrentGet() - transfer->transferRateIdealGet() );
            // find the clientMedia for the sender
            ClientMedia* clientMedia = receiver->clientMediaGetFromMediaId( transfer->mediaIdGet() );
            if ( clientMedia != 0 )
            {
                clientMedia->downloadingSet( clientMedia->downloadingGet() - 1 );
                clientMedia->sizeCurrentSet( clientMedia->sizeCurrentGet() + transfer->transferByteLengthGet() );
                if ( clientMedia->sizeCurrentGet() == clientMedia->sizeGet() )
                {
                    clientMedia->completeSet( true );
                    // Inform the client that the Media is officially complete
                    Message* m = new Message( );
                    m->toldSet( receiver->idGet() );
                    m->fromIdSet( SCHEDULER_ID );
                    m->passiveSendSet( receiver->passiveGet() );
                }
            }
        }
    }
}

```

```

char s[ SCHEDULER_STRING_SIZE ];
sprintf( s, "mediaComplete( %d );", transfer->mediaIdGet() );
m->messageSet( s );
m->timestampSet( timeGet() );
messageEngine->messageSend( &alioSession, m );
// make sure the receiver's media count is right
receiver->mediaProcess( timeGet() );
// Make sure the client sorts out
receiver->downlinkLastSet( timeGet() );
// Check to see if the client is done preloading
if ( receiver->preloadingGet() )
{
    if ( receiver->mediaAvailableCountGet() >= SCHEDULER_WATCHABLE_MAX )
        receiver->preloadingSet( false );
}
Log::L( &alioSession, 3, "Scheduler", "Media Complete Message", m->messageGet() );
}
}
// Update the space on disk
receiver->storageCurrentSet( receiver->storageCurrentGet() + transfer->transferByteLengthGet() );
// Now get all the media counters, etc. up to date
receiver->mediaProcess( timeGet() );
// Now dump the transfer record
transfer->deleteObject();
}
}
}
void Scheduler::processMessageTransferTimeout( int UNUSED fromId, Array< char* > UNUSED * arguments )
{
    //transferStateSet( fromId, Transfer::TRANSFER_ );
}
/** Cancel the transfer for the other party too
**/
void Scheduler::processMessageTransferError( int UNUSED fromId, Array< char* > * arguments )
{
    int transferId = -1;
    sscanf( arguments->elementGet( 1 ), "%d", &transferId );
    Transfer* transfer = Transfer::Find( &alioSession, transferId );
    if ( transfer )
    {
        // put them both offline for a bit
        ClientInfo* ci;
        ci = ClientInfo::Find( &alioSession, transfer->toClientIdGet() );
        if ( ci )
            ci->connectedSet( false );
        ci = ClientInfo::Find( &alioSession, transfer->fromClientIdGet() );
        if ( ci )
            ci->connectedSet( false );
        transferAbort( transfer );
        transfer->deleteObject();
    }
}

```

```

    }
}
/** Media Authorization Request
**/
void Scheduler::processMessageMediaAuthorizationRequest( int fromId, Array< char* > * arguments )
{
    // Arg 0: mediaAuthorizationRequest
    // Arg 1: mediaId
    int mediaInfold = -1;
    sscanf( arguments->elementGet( 1 ), "%d", &mediaInfold );
    ClientInfo* clientInfo = ClientInfo::Find( &alioSession, fromId );
    if ( clientInfo )
    {
        ClientMedia* clientMedia = clientInfo->clientMediaGetFromMediaId( mediaInfold );
        if ( clientMedia )
        {
            // Debit client account
            Customer* customer = Customer::Find( &alioSession, clientInfo->customerIdGet() );
            if ( customer )
            {
                customer->accountSet( customer->accountGet() + SCHEDULER_MEDIA_COST );
            }
            // Keep a record here
            clientMedia->authorize( timeGet(), SCHEDULER_MEDIA_AUTHORIZATION_TIME );
            // Authorize the movie
            Message* m = new Message( );
            m->toldSet( fromId );
            m->fromIdSet( SCHEDULER_ID );
            m->passiveSendSet( clientInfo->passiveGet() );
            char s[ SCHEDULER_STRING_SIZE ];
            sprintf( s, "mediaAuthorize( %d );", mediaInfold );
            m->messageSet( s );
            m->timestampSet( timeGet() );
            messageEngine->messageSend( &alioSession, m );
        }
    }
}

void Scheduler::processMessageClientMediaMove( int fromId, Array< char* > * arguments )
{
    // Arg 0: mediaAuthorizationRequest
    // Arg 1: rank old
    // Arg 2: rank new
    int rankOld = -1;
    sscanf( arguments->elementGet( 1 ), "%d", &rankOld );
    int rankNew = -1;
    sscanf( arguments->elementGet( 2 ), "%d", &rankNew );
    mediaItemMove( fromId, rankOld, rankNew );
}

void Scheduler::processMessageClientMediaAdd( int fromId, Array< char* > * arguments )
{

```

```

// Arg 0: mediaAuthorizationRequest
// Arg 1: rank
// Arg 2: mediaId
int rank = -1;
sscanf( arguments->elementGet( 1 ), "%d", &rank );
int mediaId = -1;
sscanf( arguments->elementGet( 2 ), "%d", &mediaId );
mediaItemAdd( fromId, rank, mediaId );
}

void Scheduler::processMessageClientMediaRemove( int fromId, Array< char* >* arguments )
{
    // Arg 0: mediaAuthorizationRequest
    // Arg 1: rank
    int rank = -1;
    sscanf( arguments->elementGet( 1 ), "%d", &rank );
    mediaItemRemove( fromId, rank );
}

void Scheduler::mediaItemRemove( int clientId, int rank )
{
    if ( clientId != -1 && rank != -1 )
    {
        ClientInfo* ci = ClientInfo::Find( &alioSession, clientId );
        if ( ci )
            ci->clientMediaRemove( rank );
        Log::L( &alioSession, 3, "Scheduler", "mediaItemRemove", "Succeeded Client %d Rank %d", clientId, rank );
    }
    else
        Log::L( &alioSession, 2, "Scheduler", "mediaItemRemove", "Failed Client %d Rank %d", clientId, rank );
}

void Scheduler::mediaItemMove( int clientId, int rankOld, int rankNew )
{
    if ( clientId != -1 && rankOld != -1 && rankNew != -1 )
    {
        ClientInfo* ci = ClientInfo::Find( &alioSession, clientId );
        if ( ci )
            ci->clientMediaMove( rankOld, rankNew );
        Log::L( &alioSession, 3, "Scheduler", "mediaItemMove", "Succeeded Client %d RankOld %d RankNew %d",
clientId, rankOld, rankNew );
    }
    else
        Log::L( &alioSession, 2, "Scheduler", "mediaItemMove", "Failed Client %d RankOld %d RankNew %d", clientId,
rankOld, rankNew );
}

void Scheduler::mediaItemAdd( int clientId, int rank, int mediaId )
{
    if ( clientId != -1 && rank != -1 && mediaId != -1 )
    {
        ClientInfo* ci = ClientInfo::Find( &alioSession, clientId );
        if ( ci )
            ci->clientMediaAdd( rank, mediaId );
    }
}

```

```

    Log::L( &alioSession, 3, "Scheduler", "mediaItemAdd", "Succeeded Client %d Rank %d Media %d", clientId, rank,
mediaId );
}
else
    Log::L( &alioSession, 2, "Scheduler", "mediaItemAdd", "Failed Client %d Rank %d Media %d", clientId, rank,
mediaId );
}
Transfer* Scheduler::transferStateSet( int fromId, Transfer::State state, Array< char* >* arguments )
{
    Transfer* transfer = 0;
    int transferId = -1;
    sscanf( arguments->elementGet( 1 ), "%d", &transferId );
    transfer = Transfer::Find( &alioSession, transferId );
    if ( transfer )
    {
        if ( fromId == transfer->fromClientIdGet() )
        {
            transfer->fromStateSet( state );
            transfer->fromContactProcess( timeGet(), SCHEDULER_TRANSFER_TIMEOUT );
        }
        else
        {
            transfer->toStateSet( state );
            transfer->toContactLastSet( timeGet() );
            transfer->toContactProcess( timeGet(), SCHEDULER_TRANSFER_TIMEOUT );
        }
        Log::L( &alioSession, 3, "Scheduler", "Transfer State Change", "TransferId:%d Client %d State %d", transferId,
fromId, (int)state );
    }
    else
    {
        Log::L( &alioSession, 2, "Scheduler", "Transfer State Change Error", "Cant find TransferId:%d Client %d State %d",
transferId, fromId, (int)state );
        transferAbortMessageSend( fromId, transferId );
    }
    return transfer;
}

void Scheduler::transferAbortMessageSend( int clientId, int transferId )
{
    ClientInfo* ci = ClientInfo::Find( &alioSession, clientId );
    Message* m = new Message( );
    m->toldSet( clientId );
    m->fromIdSet( SCHEDULER_ID );
    if ( ci != 0 )
        m->passiveSendSet( ci->passiveGet() );
    char s[ SCHEDULER_STRING_SIZE ];
    sprintf( s, "transferAbort( %d );", transferId );
    m->messageSet( s );
    m->timestampSet( timeGet() );
    messageEngine->messageSend( &alioSession, m );
}

```

```

}
void Scheduler::customerNewCreate( )
{
    Customer *customer = new Customer( &alioSession );
    char n[ 100 ];
    if ( ( customer->idGet() % 2 ) == 0 )
        sprintf( n, "Mr %ld", random() % 10000 );
    else
        sprintf( n, "Ms %ld", random() % 10000 );
    customer->nameSet( n );
    customer->clientNewSet( 1 );
    int ms[ SCHEDULER_MEDIA_COUNT ];
    for ( int i = 0; i < SCHEDULER_MEDIA_COUNT; i++ )
    {
        ms[ i ] = i;
    }
    for ( int i = 0; i < SCHEDULER_MEDIA_COUNT; i++ )
    {
        int a = random() % SCHEDULER_MEDIA_COUNT;
        int b = random() % SCHEDULER_MEDIA_COUNT;
        int t;
        t = ms[ a ];
        ms[ a ] = ms[ b ];
        ms[ b ] = t;
    }
    CustomerMedia* customerMedia[ SCHEDULER_CUSTOMER_LIST_SIZE ];
    for ( int i = 0; i < SCHEDULER_CUSTOMER_LIST_SIZE; i++ )
    {
        customerMedia[ i ] = new CustomerMedia( &alioSession );
        customerMedia[ i ]->customerIdSet( customer->idGet() );
        customerMedia[ i ]->mediaIdSet( ms[ i ] );
        customerMedia[ i ]->rankSet( i );
    }
    customerCount++;
}

void Scheduler::databaseInitialize( int init )
{
    AlioError status = alioSession.connect( "localhost", "alio_scheduler", "test", 0 );
    if ( status != ALIO_OK )
    {
        printf( " Couldn't connect to the DB %d\n", status );
        return;
    }
    if ( init )
    {
        MediaInfo::TableDrop( &alioSession );
        Log::TableDrop( &alioSession );
        Message::TableDrop( &alioSession );
        ClientInfo::TableDrop( &alioSession );
        ClientMedia::TableDrop( &alioSession );
    }
}

```

```

Transfer::TableDrop( &alioSession );
Customer::TableDrop( &alioSession );
CustomerMedia::TableDrop( &alioSession );
}
MediaInfo::TableConfirm( &alioSession );
ClientInfo::TableConfirm( &alioSession );
ClientMedia::TableConfirm( &alioSession );
Transfer::TableConfirm( &alioSession );
Message::TableConfirm( &alioSession );
Log::TableConfirm( &alioSession );
Customer::TableConfirm( &alioSession );
CustomerMedia::TableConfirm( &alioSession );
if ( init )
{
    MediaInfo::SamplesCreate( &alioSession, 0, SCHEDULER_MEDIA_COUNT );
//    CustomerMedia::SamplesCreate( &alioSession, 5, 5 );
//    Customer::SamplesCreate( &alioSession, 0, 5 );
}
}

void Scheduler::timeSubtract( struct timeval* diff, struct timeval* start, struct timeval* end )
{
    diff->tv_sec = end->tv_sec - start->tv_sec;
    diff->tv_usec = end->tv_usec - start->tv_usec;
    if (diff->tv_usec < 0)
    {
        --diff->tv_sec;
        diff->tv_usec += 1000000;
    }
}

// transfer_engine.cpp
// Copyright (c) 2004, Alio TV. All Rights Reserved.
#include <transfer_engine.h>
#include "stdio.h"
#include "time.h"
#include "sys/time.h"
#include <log.h>
#include <sys/types.h>
#include <sys/stat.h>
#include <sys/socket.h> // sockets
#include <netinet/in.h> // sockets
#include <arpa/inet.h> // sockets
#include <netdb.h>
#include <unistd.h>
#include <stdlib.h> // malloc
#include <fcntl.h>
#include <time.h>
#include <errno.h> // for CONREFUSED
#include <client_info.h>
#include <alio.h>
#define RESOLUTION          1000

```

```

#define PATH_LENGTH          100
#define TRANSFER_PROGRESS_THRESHOLD  10000000LL
TransferEngine* theTransferEngine;
static void* threadRunCall( void* transferRecordVP )
{
    TransferRecord* transferRecord = (TransferRecord*)transferRecordVP;
    transferRecord->transferEngine->threadRunning( transferRecord );
    return NULL;
}

TransferRecord::TransferRecord( TransferEngine* transferEngineInit,
                                int schedulerTransferIdInit,
                                int localIdInit,
                                int localTransferPortInit,
                                int localClientMediaIdInit,
                                int remoteIdInit,
                                char* remoteIPAddressInit,
                                int remoteTransferPortInit,
                                bool localActiveInit, bool localSendsInit,
                                char* localPathInit,
                                long long startInit,
                                long long lengthInit,
                                bool virtualTransferInit )
{
    transferEngine = transferEngineInit;
    schedulerTransferId = schedulerTransferIdInit,
    localId = localIdInit,
    localTransferPort = localTransferPortInit,
    localClientMediaId = localClientMediaIdInit;
    remoteId = remoteIdInit;
    if ( remoteIPAddressInit != 0 )
        remoteIPAddress = strdup( remoteIPAddressInit );
    else
        remoteIPAddress = 0;
    if ( localPathInit != 0 )
        localPath = strdup( localPathInit );
    else
        localPath = 0;
    remoteTransferPort = remoteTransferPortInit;
    localActive = localActiveInit;
    localSends = localSendsInit;
    start = startInit;
    length = lengthInit;
    current = 0;
    virtualTransfer = virtualTransferInit;
}

TransferRecord::~TransferRecord( )
{
    if ( remoteIPAddress != 0 )
        free( remoteIPAddress );
    if ( localPath != 0 )

```

```

    free( localPath );
}
TransferEngine::TransferEngine( int idInit, const char UNUSED *databaseName )
{
    id = idInit;
    transferEngineCallbackInterface = 0;
    pathBase = strdup( "." );
    // databaseConnectionInitialize( databaseName );
}
void TransferEngine::pathBaseSet( const char* pathBaseInit )
{
    if ( pathBase != 0 )
        free( pathBase );
    pathBase = strdup( pathBaseInit );
}
void TransferEngine::transferStart( int schedulerTransferId,
                                    int localId,
                                    int localTransferPort,
                                    int localClientMediaId,
                                    int remoteId,
                                    char* remoteIPAddress,
                                    int remoteTransferPort,
                                    bool localActive, bool localSends,
                                    char* localPath,
                                    long long start,
                                    long long length,
                                    bool virtualTransfer )
{
    char p[ PATH_LENGTH ];
    sprintf( p, "%s/%s", pathBase, localPath );
    TransferRecord* transferRecord = new TransferRecord( this, schedulerTransferId,
                                                         localId,
                                                         localTransferPort,
                                                         localClientMediaId,
                                                         remoteId,
                                                         remoteIPAddress,
                                                         remoteTransferPort,
                                                         localActive, localSends,
                                                         p, start, length,
                                                         virtualTransfer );

    pthread_t transferThread;
    if ( pthread_create( &transferThread, NULL, threadRunCall, transferRecord ) )
    {
        printf( "THREAD CREATE FAILED\n" );
        delete transferRecord;
    }
    else
    {
        // this is risky
        transferRecord->thread = transferThread;
    }
}

```

```

    pthread_detach( transferThread );
}
}
void TransferEngine::transferCancel( int UNUSED schedulerTransferId )
{
}
void TransferEngine::threadRunning( TransferRecord* transferRecord )
{
    long long total_bytes_remaining;
    int mySocket;           // TCP/IP stuff
    int acceptSocket;
    int transferSocket;     // which one (my or accept) to use for the transfer
    struct sockaddr_in socketInternetAddress;
    int fd;                 // fd for the file being transferred
    char *buffer;           // read or write buffer
    int retval;
    struct stat statStruct;  // the reader needs to know the size of the file
    int retry;
    pthread_setcancelstate( PTHREAD_CANCEL_ENABLE, NULL );
    pthread_setcanceltype( PTHREAD_CANCEL_DEFERRED, NULL );
    printf( "TE TRANSFER START %s %ld %ld\n", transferRecord->localPath, transferRecord->start, transferRecord->length );
    if( transferRecord->virtualTransfer )
    {
        sleep( 5 );
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferStarting( transferRecord->localId, transferRecord->schedulerTransferId );
    };
    sleep( 5 );
    if ( transferEngineCallbackInterface != 0 )
    {
        if ( transferRecord->localActive )
            transferEngineCallbackInterface->transferConnecting( transferRecord->localId, transferRecord->schedulerTransferId );
        else
            transferEngineCallbackInterface->transferListening( transferRecord->localId, transferRecord->schedulerTransferId );
    };
    sleep( 5 );
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferTransferring( transferRecord->localId, transferRecord->schedulerTransferId );
    long long time = 0;
    //long long unit = 1966080;
    long long unit = 10000000;
    for ( long long i = transferRecord->start; i < transferRecord->start + transferRecord->length; i += unit )
    {
        sleep ( 5 );
        long long x;
        long long remaining;

```

```

    remaining = transferRecord->length - transferRecord->current;
    x = ( remaining < unit ) ? remaining : unit;
    transferRecord->current += x;
    time += 10;
    if ( transferEngineCallbackInterface != 0 )
    {
        // must send a PROGRESS message right before the transferComplete message is sent
        transferEngineCallbackInterface->transferProgress( transferRecord->localId, transferRecord-
>schedulerTransferId,
                                transferRecord->localClientMediaId, transferRecord->localSends, x, time );
    }
}
if ( transferEngineCallbackInterface != 0 )
    transferEngineCallbackInterface->transferComplete( transferRecord->localId, transferRecord-
>schedulerTransferId,
                                transferRecord->localClientMediaId, transferRecord->localSends );

printf( "TE TRANSFER DONE\n" );
// clean up
delete transferRecord;
return;
} // if( transferRecord->virtualTransfer )
// initialize stuff
mySocket    = 0;
acceptSocket = 0;
transferSocket = 0;
fd          = 0;
// prepare what we can of the socket address. the address and port depend on whether we're active or passive.
bzero( ( char* ) &socketInternetAddress, sizeof( socketInternetAddress ) );
socketInternetAddress.sin_family = AF_INET;
// allocate the buffer
if ( ! (buffer = ( char* ) malloc(MAX_BUF_SIZE) ) )
{
    perror("malloc");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
// open the file. if sender, open for reading
if ( transferRecord->localSends )
{
    fd = open(transferRecord->localPath, O_RDONLY );
    if( fd == -1 )
    {
        perror( "open" );
        if ( transferEngineCallbackInterface != 0 )

```

```

    transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}

// get the size of the file
retval = fstat( fd, &statStruct);
if( retval )
{
    perror( "fstat");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}

printf( "file size %lld bytes, to transfer %lld, offset %lld\n",
        (long long) statStruct.st_size, transferRecord->length , transferRecord->start );
// if the offset + the requested size > file size, complain
if( transferRecord->length + transferRecord->start > ( long long )statStruct.st_size)
{
    printf("file isn't big enough for the requested transfer\n");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
}
else
{
    // we are the receiver, so open the file for writing, creating if necessary
    fd = open( transferRecord->localPath, O_WRONLY | O_CREAT, FILE_CREATE_MODE );
    if( fd == -1 )
    {
        perror( "open");
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
        if( mySocket ) close( mySocket );
        if( acceptSocket ) close( acceptSocket );
        if( fd ) close( fd );
        if( buffer ) free( buffer );
    }
}

```

```

    delete transferRecord;
    return;
}
}
// seek into the file. same for both sender and receiver
retval = lseek( fd, transferRecord->start, SEEK_SET);
if( retval == -1 )
{
    perror( "lseek");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
// open a socket; if we're the active partner, this will be our transfer socket.
// on the other hand, if we're the passive partner, we'll use this socket to
// listen for connections.
if( ( mySocket = socket( AF_INET, SOCK_STREAM, 0 ) ) == -1 )
{
    perror("socket");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
// set up socket and make connection, depending on whether
// we're the active or the passive party
if ( transferRecord->localActive )
{
    printf(" active partner - 1 sec\n");
    sleep( 10 );
    printf(" active partner - calling %s\n", transferRecord->remoteIPAddress );
    // the socket address will be the remote address
    inet_pton(AF_INET, transferRecord->remoteIPAddress, &socketInternetAddress.sin_addr);
    socketInternetAddress.sin_port = htons( transferRecord->remoteTransferPort );
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferConnecting( transferRecord->localId, transferRecord-
>schedulerTransferId );
    retry = CONNECT_RETRIES_MAX;
    while( retry-- )
    {
        retval = connect( mySocket,

```

```

        (struct sockaddr *)&socketInternetAddress,
        sizeof(socketInternetAddress)) ;
    if ( retval == 0)
        break;
    if ( retval == -1)
    {
        if( ECONNREFUSED == errno )
        {
            printf("connection refused - will retry\n");
        }
        else
            perror("connect");
        if (CONNECT_RETRY_SLEEP_SECONDS ) sleep( CONNECT_RETRY_SLEEP_SECONDS );
        continue;
    }
}
// we're either connected or we've exhausted the retries
if( retval )
{
    printf ("connect: exhausted retries\n");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
printf("active partner, connected\n");
// note that this socket will be used for the transfer
transferSocket = mySocket;
}
else // passive
{
    printf( "passive partner, calling accept\n" );
    socketInternetAddress.sin_addr.s_addr = INADDR_ANY;
    socketInternetAddress.sin_port = htons( transferRecord->localTransferPort );
    // allow reuse of the socket address to avoid bind failures
    int yes=1; // reuse the socket
    retval = setsockopt ( mySocket,
                        SOL_SOCKET,
                        SO_REUSEADDR,
                        ( char* ) &yes,
                        sizeof( yes ) );
    if( retval )
    {
        perror( "setsockopt" );
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    }
}

```

```

    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
printf( "passive partner, binding\n" );
// bind the socket to the address
retry = BIND_RETRIES_MAX;
while(retry--)
{
    if ( retval = bind( mySocket,
                      (struct sockaddr *) &socketInternetAddress,
                      sizeof( socketInternetAddress ) ) )
    {
        perror( "bind" );
        if (CONNECT_RETRY_SLEEP_SECONDS ) sleep( CONNECT_RETRY_SLEEP_SECONDS );
        continue;
    }
    break;
}
// we're either bound or we've exhausted the retries
if( retval )
{
    printf ( "bind: exhausted retries\n");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
if ( transferEngineCallbackInterface != 0 )
    transferEngineCallbackInterface->transferListening( transferRecord->localId, transferRecord->schedulerTransferId
);
printf( "passive partner, listening\n" );
if( listen( mySocket, 1 ) )
{
    perror ( "listen" );
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}

```

```

}
struct timeval timeout;
timeout.tv_sec = ACCEPT_TIMEOUT_SECONDS;
timeout.tv_usec = ACCEPT_TIMEOUT_MILLISECONDS;
printf( "passive partner, accepting\n" );
acceptSocket = acceptWithTimeout(
    mySocket,
    &socketInternetAddress,
    timeout);
if ( acceptSocket == -1 )
{
    perror ( " accept" );
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
printf( "client %s has connected\n", inet_ntoa( socketInternetAddress.sin_addr ) );
transferSocket = acceptSocket;
// close the listen socket, now the accept one is running
if( mySocket )
{
    close( mySocket );
    mySocket = 0;
}
}
// start the transfer
total_bytes_remaining = transferRecord->length;
printf("have to transfer %lld bytes\n", total_bytes_remaining );
if ( transferEngineCallbackInterface != 0 )
    transferEngineCallbackInterface->transferStarting( transferRecord->localId, transferRecord->schedulerTransferId );
// make note of the starting time
long long elapsedTime = 0;
time_t timeStarted;
time_t timeNow;
if( -1 == time( &timeStarted ) )
{
    perror("time");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
} // continue anyway, but elapsed time might be bogus
if ( transferEngineCallbackInterface != 0 )
    transferEngineCallbackInterface->transferTransferring( transferRecord->localId, transferRecord->
>schedulerTransferId );
long long transfered = 0;
do

```

```

{
if ( transferRecord->localSends )
{ // sender
int bytes_to_read_this_read;
int bytes_read_this_read;
int bytes_sent_this_send;
int bytes_sent_this_read;
memset(buffer, 0, MAX_BUF_SIZE);
// how many bytes to ask for?
bytes_to_read_this_read = ( total_bytes_remaining < MAX_BUF_SIZE )
    ? total_bytes_remaining
    : MAX_BUF_SIZE ;
bytes_read_this_read = read( fd, buffer, bytes_to_read_this_read );
if( -1 == bytes_read_this_read )
{
perror( "read");
if ( transferEngineCallbackInterface != 0 )
transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
if( mySocket ) close( mySocket );
if( acceptSocket ) close( acceptSocket );
if( fd ) close( fd );
if( buffer ) free( buffer );
delete transferRecord;
return;
}
// printf( "remaining %lld bytes, read %d\n", total_bytes_remaining , bytes_read_this_read );
if( 0 == bytes_read_this_read )
{
printf("end of file\n");
if( total_bytes_remaining )
{
printf("ERROR: reached EOF but still have bytes to send\n");
if ( transferEngineCallbackInterface != 0 )
transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
if( mySocket ) close( mySocket );
if( acceptSocket ) close( acceptSocket );
if( fd ) close( fd );
if( buffer ) free( buffer );
delete transferRecord;
return;
}
else
{
printf("LOGIC ERROR: still in loop but no bytes remaining\n");
if ( transferEngineCallbackInterface != 0 )
transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
if( mySocket ) close( mySocket );
if( acceptSocket ) close( acceptSocket );

```

```

        if( fd ) close( fd );
        if( buffer ) free( buffer );
        delete transferRecord;
        return;
    }
}
if( bytes_to_read_this_read != bytes_read_this_read )
{
    printf("read less than the buffer size: odd, but not an error\n");
}
bytes_sent_this_read = 0;
do
{
    bytes_sent_this_send = send( transferSocket,
                                buffer + bytes_sent_this_read,
                                bytes_read_this_read - bytes_sent_this_read,
                                0);
    if( -1 == bytes_sent_this_send )
    {
        perror( "send" );
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
        if( mySocket ) close( mySocket ); //TODO do this on every return
        if( acceptSocket ) close( acceptSocket );
        if( fd ) close( fd );
        if( buffer ) free( buffer );
        delete transferRecord;
        return;
    }
    bytes_sent_this_read += bytes_sent_this_send;
} while ( bytes_sent_this_read < bytes_read_this_read );
total_bytes_remaining -= bytes_sent_this_read;
transferred += bytes_sent_this_read;
}
else
{ // receiver
    int bytes_to_receive_this_receive;
    int bytes_received_this_receive;
    int bytes_written_this_write;
    int bytes_written_this_receive;
    memset(buffer, 0, MAX_BUF_SIZE);
    // how many bytes to ask for?
    bytes_to_receive_this_receive = ( total_bytes_remaining < MAX_BUF_SIZE )
        ? total_bytes_remaining
        : MAX_BUF_SIZE ;
    bytes_received_this_receive = recv( transferSocket,
                                        buffer,
                                        bytes_to_receive_this_receive,
                                        0);

```

```

if( -1 == bytes_received_this_receive )
{
    perror( "recv");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
    if( mySocket ) close( mySocket );
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
// printf( "remaining %lld bytes, received %d\n", total_bytes_remaining, bytes_received_this_receive );
if( 0 == bytes_received_this_receive )
{
    printf("end of file\n");
    if( total_bytes_remaining )
    {
        printf("ERROR: reached EOF but still have bytes to send\n");
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
        if( mySocket ) close( mySocket );
        if( acceptSocket ) close( acceptSocket );
        if( fd ) close( fd );
        if( buffer ) free( buffer );
        delete transferRecord;
        return;
    }
    else
    {
        printf("LOGIC ERROR: still in loop but no bytes remaining\n");
        if ( transferEngineCallbackInterface != 0 )
            transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
        if( mySocket ) close( mySocket );
        if( acceptSocket ) close( acceptSocket );
        if( fd ) close( fd );
        if( buffer ) free( buffer );
        delete transferRecord;
        return;
    }
}
if( bytes_to_receive_this_receive != bytes_received_this_receive )
{
    //printf("received less than the requested: odd, but not an error\n");
}
bytes_written_this_receive = 0;
do
{

```

```

bytes_written_this_write = write( fd,
                                buffer + bytes_written_this_receive,
                                bytes_received_this_receive - bytes_written_this_receive);
if( -1 == bytes_written_this_write )
{
    perror( "write" );
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId
);
    if( mySocket ) close( mySocket ); //TODO do this on every return
    if( acceptSocket ) close( acceptSocket );
    if( fd ) close( fd );
    if( buffer ) free( buffer );
    delete transferRecord;
    return;
}
bytes_written_this_receive += bytes_written_this_write ;
} while( bytes_written_this_receive < bytes_received_this_receive );
total_bytes_remaining -= bytes_written_this_receive;
transferred += bytes_written_this_receive;
}
// how long have we been running?
if( -1 == time( &timeNow ) )
{
    perror("time");
    if ( transferEngineCallbackInterface != 0 )
        transferEngineCallbackInterface->transferError( transferRecord->localId, transferRecord->schedulerTransferId );
} // continue anyway, but elapsed time might be bogus
elapsedTime = (long long) timeNow - timeStarted;
// must send a PROGRESS message right before the transferComplete message is sent
if ( transferEngineCallbackInterface != 0 &&
    ( transferred > TRANSFER_PROGRESS_THRESHOLD ||
      total_bytes_remaining == 0 ) )
{
    transferEngineCallbackInterface->transferProgress( transferRecord->localId,
        transferRecord->schedulerTransferId,
        transferRecord->localClientId,
        transferRecord->localSends,
        transferred,
        elapsedTime );
    transferred = 0;
}
} while ( total_bytes_remaining );
printf("transfer took %lld seconds\n", elapsedTime );
if ( transferEngineCallbackInterface != 0 )
    transferEngineCallbackInterface->transferComplete( transferRecord->localId, transferRecord->schedulerTransferId,
        transferRecord->localClientId, transferRecord->localSends );

// clean up
if( mySocket ) close( mySocket );
if( acceptSocket ) close( acceptSocket );

```

```

    if( fd          ) close( fd          );
    if( buffer      ) free( buffer      );
    delete transferRecord;
    printf( "TE TRANSFER DONE\n" );
    return;
}

void TransferEngine::databaseConnectionInitialize( const char* database )
{
    AlioError status = alioSession.connect( "localhost", (char*)database, "test", 0 );
    if ( status != ALIO_OK )
    {
        printf( " Couldn't connect TE to the DB %s : Error %d\n", database, status );
        return;
    }
}

long long TransferEngine::timeGet( )
{
    return time( 0 );
}

// call accept with a timeout. if any system calls fail, or
// if the timeout occurs, return -1. calling function will
// be responsible for recovery or cleaning up and informing the system
// of the failure
// on success, return a new socket with the accepted connection
int TransferEngine::acceptWithTimeout( int serverSocket,
                                       struct sockaddr_in* clientInternetAddress,
                                       struct timeval   timeout)
{
    fd_set fds;
    int numFds;
    int retval;
    socklen_t clientInternetAddressLength;
    int clientSocket;
    numFds = 0;
    FD_ZERO (&fds);
    FD_SET (serverSocket, &fds);
    //printf("calling select on server socket %d\n", serverSocket);
    retval = select (serverSocket + 1, &fds, NULL, NULL, &timeout);
    if (retval < 0)
    {
        perror ("select");
        return( -1 );
    }
    if (FD_ISSET(serverSocket, &fds))
    // received a call; accept it
    {
        clientInternetAddressLength = sizeof ( struct sockaddr );
        clientSocket = accept( serverSocket,
                               (struct sockaddr*) clientInternetAddress,
                               &clientInternetAddressLength );
    }
}

```

```
if( clientSocket < 0 )
{
    perror("accept ");
    return ( -1 );
}
printf( "client %s connected\n",
        inet_ntoa ( clientInternetAddress->sin_addr ) );
return( clientSocket );
}
// otherwise we must have simply timed out
printf( "client connection timeout\n");
return ( -1 );
}
```